

Computer Network Architecture

Lecture 6:

Network Connectivity Devices

Assistant lecturer: Suad Abdulelah Alasai

Network Devices- Terminology

- Some terminology related to the operation of network devices is:
 - **Domain** is a specific part of a network.
 - **Bandwidth** is the amount of data that can be carried across a network in a given time period.
 - **Unicast data** is data meant for a specific device.
 - **Broadcast data** is data meant for all devices; a special broadcast address indicates this.
 - **Multicast data** is data destined for a specific group of devices; a special address indicates this.
 - **A bandwidth domain**, known as a *collision domain* for Ethernet LANs, includes all devices that share the same bandwidth.
 - **A broadcast domain** includes all devices that receive each other's' broadcasts (and multicasts)

Network Devices

- Network devices are the devices that interconnect networks. Because these devices connect network entities, they are known as **connectivity devices**. These devices include:
 - ❖ Network Interface Card (NIC)
 - ❖ Hub
 - ❖ Switch
 - ❖ Bridge
 - ❖ Router
 - ❖ Gateway

Network Devices- NIC

- **Network Interface Card (NIC)**

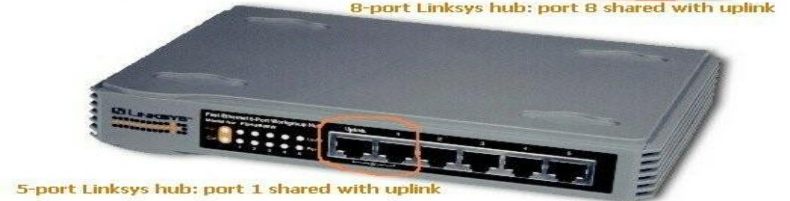
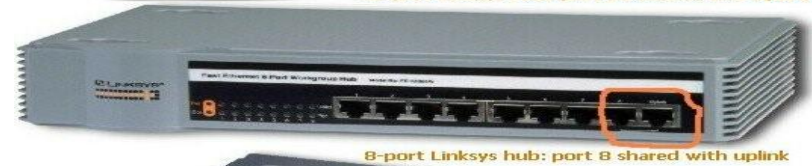
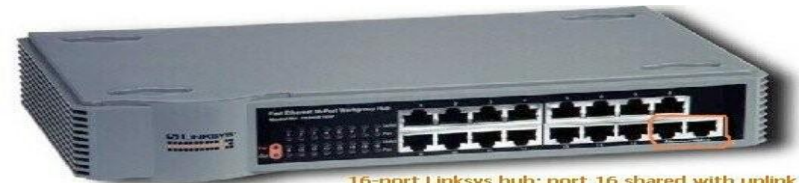
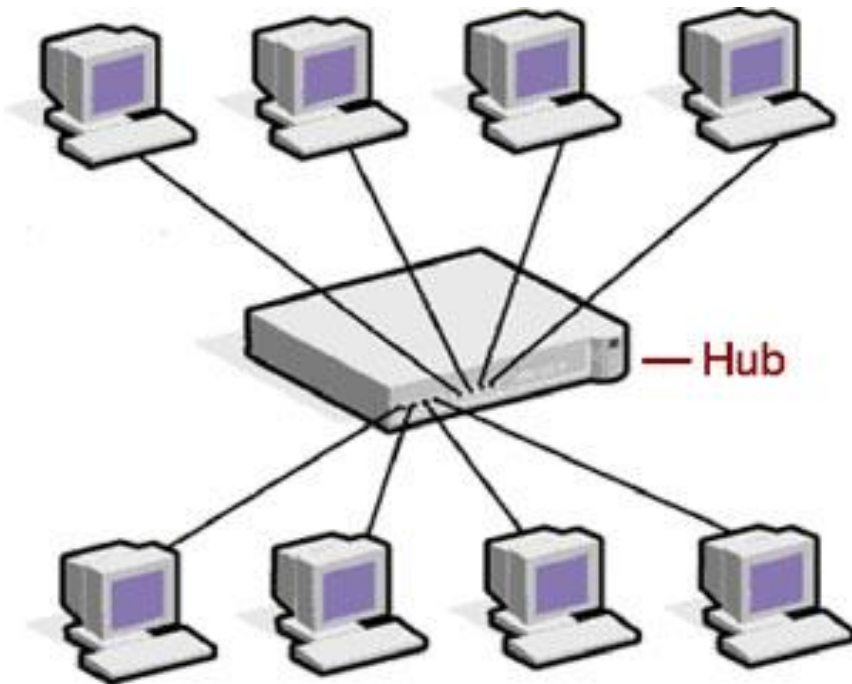
The *network interface card (NIC)*, as its name suggests, is the expansion card you install in your computer to connect, or interface, your computer to the network. This device provides the physical, electrical, and electronic connections to the network media. A NIC is either an expansion card (the most popular implementation) or built in to the motherboard of the computer. NIC provides the physical interface between computer and cabling.

It prepares data, sends data, and controls the flow of data. It can also receive and translate data into bytes for the CPU to understand.

Network Devices - Hub

- **Hub**
- A typical Ethernet LAN uses unshielded twisted-pair (UTP) cables with RJ-45 connectors.
- Because these cables have only two ends, an intermediary device is needed to connect more than two computers. That device is **a hub**. Hubs are devices used to link several computers together.
- A hub works at Layer 1 and connects **multiple devices** so that they are logically all on one LAN.
- **NOTE:** The physical connection point on a network device—a hub, switch, or router—is called an ***interface*** or a ***port***.
- A hub has no intelligence—it sends all data received on any port to all the other ports. So, devices connected through a hub receive everything that the other devices send, whether or not it was meant for them. This process called **broadcasting**).
- All devices connected to a hub are in one collision domain and one broadcast domain.
- Note: A hub just repeats all the data received on any port to all the other ports; thus, **hubs are also known as *repeaters***.

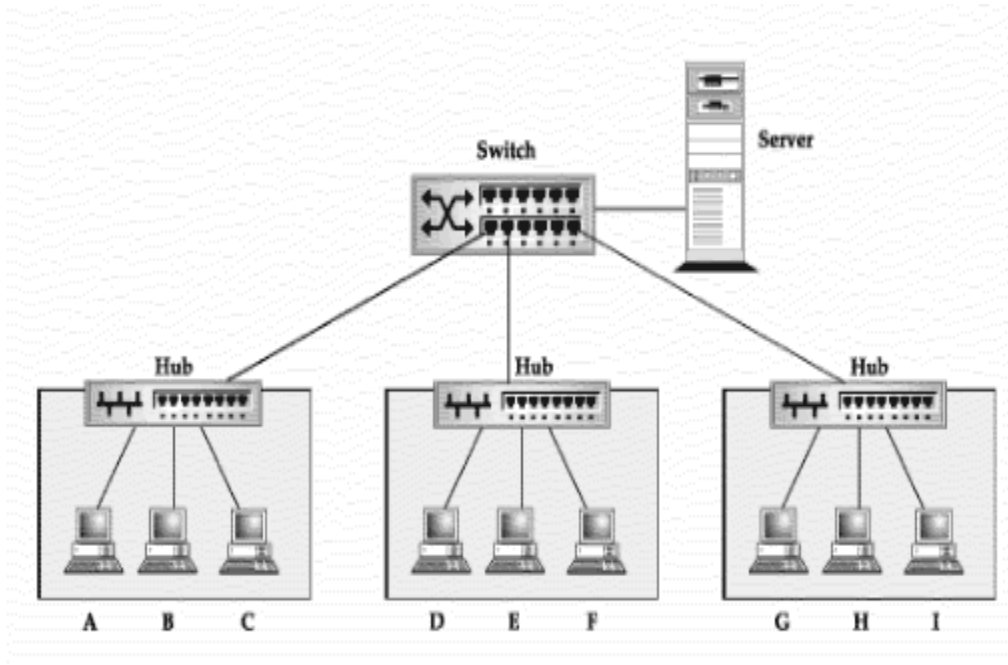
Network Devices - Hub



Network Devices- Switch

- **LAN** switches are **Layer 2** devices and have some intelligence—they send data to a port only if the data needs to go there.
- A device connected to a switch port does not receive any of the information addressed to devices on other ports. Therefore, the main advantage of using a switch instead of a hub is that the traffic received by a device is reduced because only frames addressed to a specific device are forwarded to the port on which that device is connected.
- Switches read the source and destination MAC addresses in the frames and therefore can keep track of who is where, and who is talking to whom, and send data only where it needs to go.
- If the switch receives a frame whose destination address indicates that it is a broadcast (information meant for everyone) or multicast (information meant for a group), by default it sends the frame out all ports (except for the one on which it was received).
- All devices connected to one switch port are in the same collision domain, but devices connected to different ports are in different collision domains. By default, all devices connected to a switch are in the same broadcast domain.

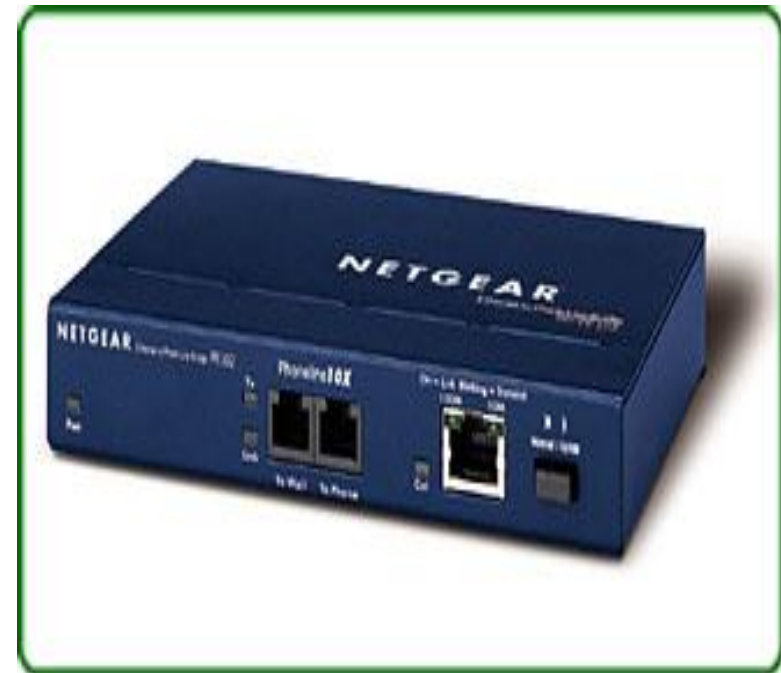
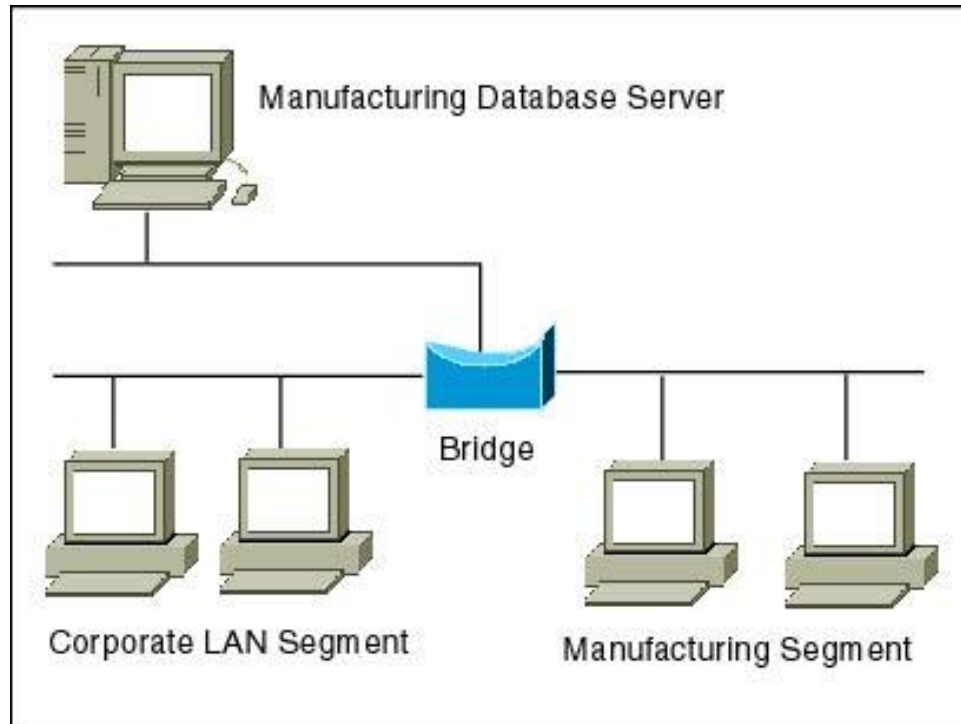
Network Devices- Switch



Network Devices- Bridge

- Bridge is a network device that connects two similar network segments together. The primary function of a bridge is to keep traffic separated on both sides of the bridge.
- For example, with 200 people on one Ethernet segment, the performance will be mediocre, because of the design of Ethernet and the number of workstations that are fighting to transmit. If you divide the segment into two segments of 100 workstations each, the traffic will be much lower on either side and performance will increase.
- The main disadvantage to bridges is that they can't connect dissimilar network types or perform intelligent path selection. For that function, you would need a router.

Network Devices- Bridge



Network Devices - Router

- A *router* goes one step further than a switch. It is a Layer 3 device that has much more intelligence than a hub or switch.
- By using logical Layer 3 addresses, routers allow devices on different LANs to communicate with each other and with distant devices—for example, those connected through the Internet or through a WAN.
- The logical Layer 3 addresses is the TCP/IP's IP addresses..
- The router reads the source and destination logical addresses in the packets and therefore keeps track of who is where, and who is talking to whom, and sends data only where it needs to go.
- All devices connected to one router port are in the same collision domain, but devices connected to different ports are in different collision domains.
- Routers block broadcasts (destined for *all* networks) and multicasts by default; routers forward only *unicast* packets (destined for a specific device) and packets of a special type called *directed broadcasts*.

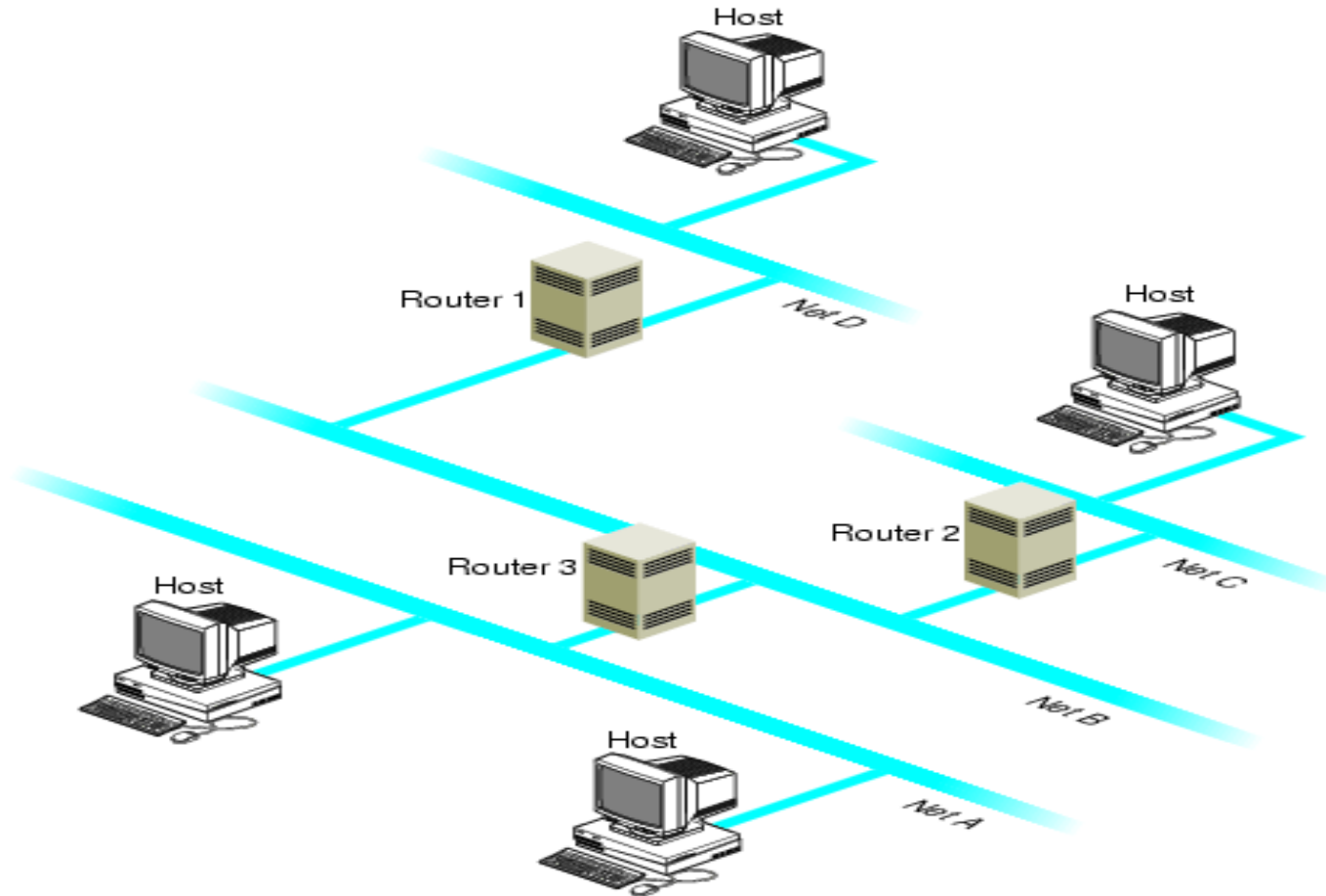
Network Devices- Router

- Routers work at the OSI model **network layer**. The main functions of a router are first to determine the best path that each packet should take to get to its destination and second to send the packet on its way.
- Sending the packet out the appropriate interface, along the best path, is also called ***switching the packet*** because the packet is encapsulated in a new frame, with the appropriate framing information.

Routers are normally used to connect one LAN to another.

Typically, when a WAN is set up, there will be at least two routers used.

Network Devices- Router



Network Devices - Gateway

- A *gateway* is any hardware and software combination that connects dissimilar network environments.
- Gateways are the most complex of network devices because they perform translations at multiple layers of the OSI model.

Thank You